# The Role of Convection and Growth Competition in Phase Selection in Microgravity (LODESTARS)

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## NASA Objectives and Contributions:

- Complex stainless steels can form a metastable dendritic ferrite phase, prior to the formation of the stable austenite phase.
- Determine governing factors behind kinetics of transformation in these commercially relevant structural materials
- Determine the effects of fluid flow in nucleation of the second phase, within the meta-stable phase in the mushy zone
- Correlate the local structure with containerless measurements of thermophysical properties

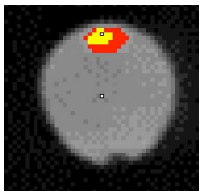
## Relevance/Impact:

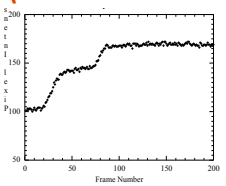
- Establish processing conditions for improving material properties and performance in cast austenitic stainless alloys
- Develop physical models to predict phase selection during strip casting. Endorsed by NUCOR Steel, Charlotte, NC.

## Development Approach:

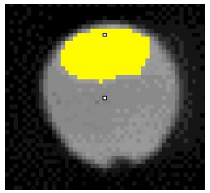
- Using containerless techniques establish a data base to test dendritic growth models over a wide range of undercoolings
- Determine the mechanism for stable phase nucleation by defining how convection influences the delay time over a broad range of fluid flow conditions
- Examine the relationship between alloy composition and transformation kinetics in these systems

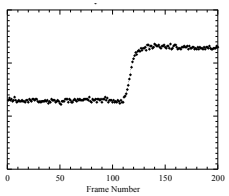
## Ground-based Research (Electrostatic Levitator)






Austenite (yellow) growth from primary ferrite (red)






Austenite growth directly from supercooled liquid (grey)

## ISS Resource Requirements

| | |
|---|---|
| **Accommodation (carrier)** | Electromagnetic Levitator (EML) in Columbus Orbiting Facility |
| **Upmass (kg)** (w/o packing factor) | 0.01 for samples |
| **Volume ($m^3$)** (w/o packing factor) | 10e-8 |
| **Power (kw)** (peak) | TBD |
| **Crew Time (hrs)** (installation/operations) | 2 |
| **Autonomous Operation** | TBD |
| **Launch/Increment** | TBD |

## Project Life Cycle Schedule

| Milestones | SCR | RDR | PDR | CDR | VRR | Safety | FHA | Launch | Ops | Return | Final Report |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Actual/ Baseline | 09/02 | | | | | | | 2012 | | | |